

## AVIAN CESTODES FROM NEW GUINEA

## III. CESTODES FROM GALLIFORMES

BY

DR. ALEXANDER KOTLÁN

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Only one representative of the bird-group Galliformes has been examined for parasites, viz., *Megapodius brunneiventris*, Mey. The tapeworms which were found in the gut of this bird belong to three distinct species of the genus *Dilepis*, Weinl; one of these is smaller and narrower than the two other species, and is, therefore, easy to separate from these latter. It requires, however, a careful examination to be able to distinguish the two other species, the scolex and strobila of which are quite similar to one another. All three species are, I believe, undescribed; the genus *Dilepis*, so far as I am aware, has not yet been recorded from Galliform birds.

*DILEPIS YORKEI*, sp. n.

Host: *Megapodius brunneiventris*, Mey.

Locality: Friedrich-Wilhelmshafen.

This is the smallest of the three species mentioned above; fully matured specimens measure 15 to 20 mm. in length. The scolex is

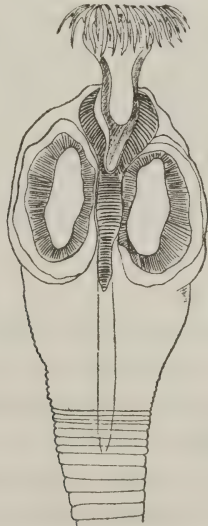


FIG. 1 *Dilepis yorkei*, sp. n. Scolex.  $\times 50$ .

very well developed, it is nearly as long (0.7 mm.) as broad (0.5 to 0.6 mm.). It bears a rather powerful rostellum of conical shape and of about 0.5 mm. in length. This rostellum, when retracted, is surrounded by a double muscular rostellar sac of about 0.7 mm. in length. On the anterior end of the rostellum there is a button-like thickening of nearly 0.17 mm. in diameter, bearing fifty to fifty-two large hooks, which are arranged in a double row.

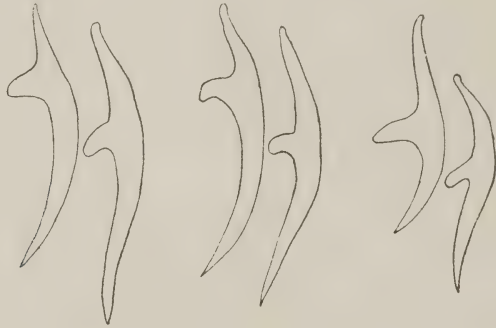


FIG. 2. Hooks from the rostellum. A.—*D. yorkei*; B.—*D. leptopballus*; C.—*D. borvábii*.  $\times 230$ .

They measure in the anterior row  $135\mu$ , in the posterior row  $148\mu$  to  $151\mu$ . The suckers are oval in shape and measure 0.42 to 0.44 by 0.25 to 0.30 mm. in diameter.

Behind the scolex there is a very short unsegmented portion, which is usually broader than the segments of the anterior half of the worm. The strobila of a fully developed specimen consists of about one hundred and twenty to one hundred and fifty segments; these are, as a rule, broader than long, except in macerated specimens. Mature segments are 0.2 to 0.4 mm. in breadth and 0.05 to 0.1 mm. in length. The greatest breadth (0.3 to 0.5 mm.) is attained in the last fourth of the strobila with gravid segments.

#### ANATOMY.

*Body-wall and parenchyma.* The cuticle, as in other similarly delicate cestodes, is rather thin and not at all compact. The sub-cuticular cells are fairly well developed and arranged into two or three rows. The body-parenchyma is of peculiar structure, consisting of a loosely arranged reticulum with rather poorly scattered cell-elements. Calcareous bodies were not found.

*Musculature.* The somewhat denser cortex is separated from the very loose medulla by the longitudinal muscles, which are arranged in two rings, each being composed of a row of small inconspicuous muscle-bundles. Inside of the interior row there is apparently a very poorly developed transverse musculature. Dorso-ventral muscle-fibres were not seen.

*Excretory system.* In the anterior two-thirds of the strobila there exist two longitudinal vessels on each side of the segments, of which the ventral is slightly larger than the dorsal. In segments in which the uterus reached a more considerable extent, only one pair of longitudinal vessels can be seen. Transverse commissures were not observed.

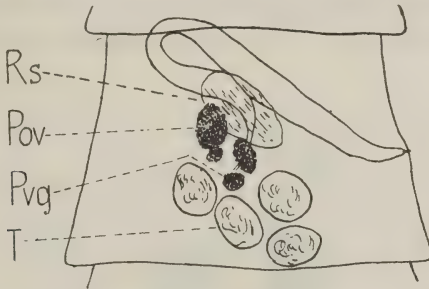


FIG. 3. *D. yorkei*, sp.n. Younger segment showing mature male organs and primordial female glands. Pov.—primordial ovary; Pvg.—primordial vitelline gland; Rs.—receptaculum seminis; T.—testes.  $\times 170$ .

*Genital organs.* The first indication of the sex-organs appears already in the first distinct segments. As in many other cestodes, the male organs are markedly more advanced in development than the female organs. The cirrus pouch attains its largest size by the twentieth segment; then follow the testes, which, however, disappear about the sixtieth to seventieth segment, while the female glands, which also appear rather early, reach full maturity after and about the eightieth segment. Here also the uterus appears, and grows rapidly to a considerable size.

The genital-openings are unilateral, being situated about the middle of the lateral border of the proglottides.

*Male organs.* The cirrus pouch, compared with the size of the proglottides, is a large tube of 0.18 to 0.2 mm. length and 0.021 to 0.027 mm. greatest breadth. Its position varies according to the

state of contraction of the worm. In somewhat longer segments it is directed obliquely to the anterior end of the segment. After narrowing for a short distance it is continued by a very wide vas deferens, which, forming one or two large coils, runs to the posterior half of the segment. The cirrus seems to be a fairly slender canal, which on its anterior end is apparently covered with minute spines.

There are only four testes in each segment, situated in the middle of the posterior third; they are  $37\mu$  by  $27\mu$  in diameter.

*Female organs.* The vagina, a fairly short and narrow canal, runs dorsally to the cirrus pouch. It forms a large (about 0.08 mm.) receptaculum seminis, which lies immediately within the dorsal longitudinal musculature extending to, or but little beyond, the middle of the proglottis. The ovary exhibits a peculiar structure,

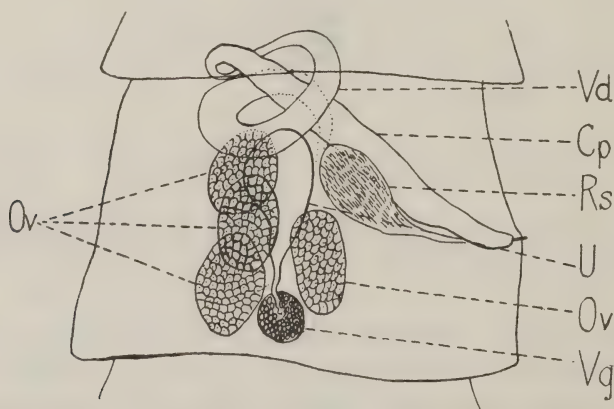


FIG. 4. *D. yorkei*, sp.n. Older segment showing mature female organs. *Cp.*—cirrus pouch; *Ov.*—ovary; *Rs.*—receptaculum seminis; *U.*—uterus; *Vg.*—vittelline gland; *Vd.*—vas deferens.  $\times 170$ .

which, though slightly modified, is characteristic of the two other species also. In the present case it consists of four nearly equal bodies, which are rounded or mostly oval in shape, measuring about  $54\mu$  to  $67\mu$  by  $40\mu$ . One of these ovarian sacs is situated in the poral half, while the three others lie antiporal, i.e., two of them ventral and one somewhat dorsal. Each ovarian sac sends out a thin-walled canal; these unite into a larger, very short oviduct. On the main trunk of the oviduct lies a rounded shell-gland.



A globular vitelline gland of  $29\mu$  diameter is seen in the mid-line towards the posterior margin of the segments.

The young uterus is a thin-walled sac, which lies ventrally in the anterior half of the segments. Growing to a more considerable size, its walls become more distinct; in this stage the female glands disappear suddenly, the whole medulla being occupied by the uterus. In the two or three last segments, however, the wall of the uterus atrophies, the ripe ova filling up the whole space of the proglottides. The rounded ova measure  $54\mu$  in diameter.

I have named this species in honour of Prof. Warrington Yorke, of the University of Liverpool.

The type specimen is in the Parasitological Museum of the Royal Hungarian Veterinary College, Budapest.

*DILEPIS LEPTOPHALLUS*, sp. n.

Host: *Megapodius brunniventris*, Mey.

Locality: Friedrich-Wilhelmshafen.

The longest worms, when fully developed, measure 80 mm. in length. The scolex is rather similar to that of the former species, its diameter being 0.68 mm. The rostellum is, in its main features, like that of *D. yorkei*, measuring 0.64 to 0.76 mm. in length. It bears on its anterior, knob-like end fifty-two hooks arranged in a double row, those in the anterior row being slightly smaller in size ( $121\mu$  to  $126\mu$ ) than those in the posterior row ( $135\mu$  to  $143\mu$ ). The four suckers are rounded in shape, measuring 0.3 to 0.34 mm. in diameter.

Segmentation begins just behind the scolex. The proglottides are, as a rule, broader than long. The ratio of the length to the breadth varies according to the different stages of contraction. This ratio is in my specimens mostly as 1 : 4-6, so far as concerns the proglottides of the anterior half of the strobila; backwards (caudad) the length increases slightly, the ratio becoming as 1 : 3. The anterior end of the proglottides is usually much narrower than the posterior, which in most specimens shows a distinct thickening.

There is a very well pronounced overlapping, especially in the posterior half of the strobila. Gravid segments are about 2.5 mm. broad and 1.5 mm. long, and exhibit a considerable thickness.

#### ANATOMY.

*Musculature.* The longitudinal muscles consist of bundles, which are arranged in two layers; the internal layer exhibits twenty-six to thirty, the external sixty-six to seventy, mostly oval bundles. The transversal musculature is very poorly developed; mostly it seems entirely absent. The dorso-ventral muscle-fibres are likewise but faintly distinguishable.

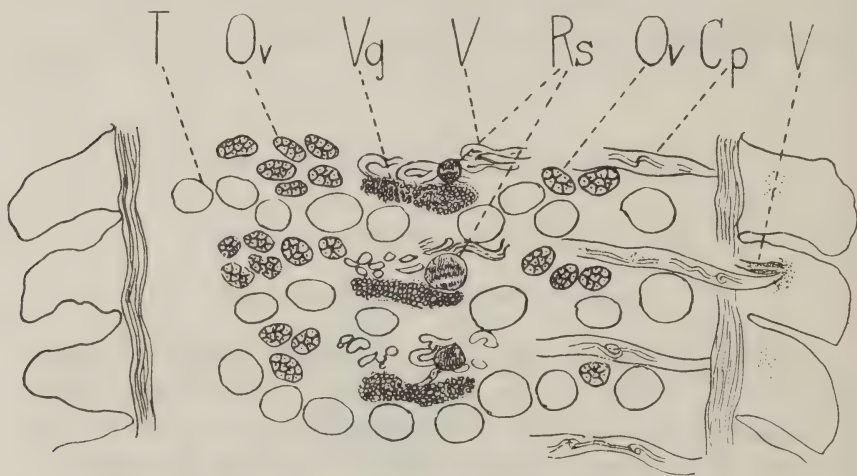


FIG. 5. *D. leptopballus*, sp.n. Longitudinal section of three mature segments. Cp.—cirrus pouch; Ov.—ovary; Rs.—receptaculum seminis; T., testes; V.—vagina; Vg.—vitelline gland.  $\times 100$ .

It is worth noting that in none of the specimens examined could any trace of calcareous bodies be detected.

*Excretory system.* This consists of two pairs of longitudinal vessels, of which only the two wide ventral ones form a transverse canal, this latter being approximately as wide as the main ventral vessels.

*Genital organs.* The openings of the genital ducts are unilateral and lie on the posterior third of the lateral border. The atrium genitale is marked off by a dense network of very small cells of rounded or oval shape.

*Male organs.* The cirrus pouch consists of a very long narrow tube of about 0.68 mm. length and 0.02 mm. breadth. Its position and course depend essentially on the state of contraction of the proglottides, and especially on the progress in development of the genital organs. According to this it runs in normally contracted mature segments from the genital pore to the excretory vessels on the transverse axis, and then turns dorsally, extending a little beyond the middle of the segments. In longer proglottides exhibiting fully developed genital glands, the course of the cirrus pouch is very different from that described above, as (seen in optical longitudinal section) it runs from about the genital pore to the anterior third of the segment parallel to the lateral border, and then turns abruptly to the median part. The cirrus pouch possesses long retractor muscles, which extend beyond the antiporal ventral

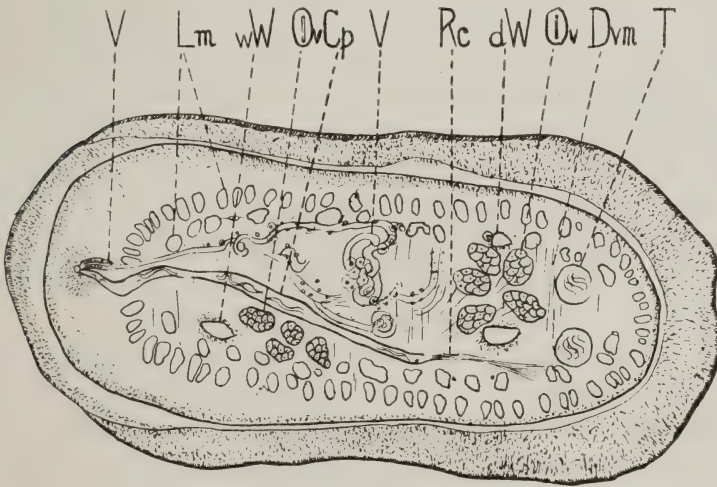


FIG. 6. *D. leptopallus*, sp.n. Transverse section of a mature segment. *Cp.*—cirrus pouch; *Dvm.*—dorsoventral muscle fibres; *Lm.*—longitudinal muscles; *Ov.*—ovary; *Rc.*—retractor muscles of the cirrus pouch; *T.*—testes; *dW.*—dorsal excretory vessel; *wW.*—ventral excretory vessel; *V.*—vagina.  $\times 80$ .

vessel. There is a coiled vas deferens, the coils of which lie in transverse section mainly dorsal, and in a somewhat higher plane than those of the vagina. The cirrus is a very long and slender ( $8\mu$ ) canal, forming usually many coils within the cirrus pouch; in some specimens, in which it was extruded, I could observe that at least on the anterior half it is covered with very minute spines.

*Female organs.* The vagina is a strikingly long duct which runs from the atrium genitale to the mid-part of the medulla, mainly just within the internal layer of the dorsal longitudinal muscles; it forms very large coils, which fill dorso-ventrally the entire central space of the medullary layer. The walls of the vagina are generally thin and covered with rounded cells; immediately before entering the small atrium genitale its walls present a slight sphincter-like thickening. Just in front of the shell-gland there is a rather large rounded receptaculum seminis. The ovary is composed of poral and antiporal lobes, each consisting of distinctly separated groups of acini, the poral lobe having about five groups and the antiporal about ten. The acini are all rather similar in size, measuring about  $43\mu$  across. Each group sends out a thin-walled, narrow canal, all of which, running into a larger one, form a distinct ovarian bridge connecting the two groups of the ovary; from the mid-part of this bridge there arises, at first somewhat dorsally directed, a rather wide oviduct. A similar structure of the ovary exists also in other cestodes, of which the following may here be mentioned:—*Choanotaenia porosa* (Rud.) (see Cohn, 1901), *Ch. gongyla*, Cohn (1901), *Anomotaenia platyrhyncha* (Krabbe), *A. microrhyncha* (Krabbe), and *Ophryocotyle herodiae*, Fuhrm. (1909). A compact, somewhat bean-like vitelline gland lies in the middle of the medulla; it measures 0.14 mm. At the junction of the oviduct and vitelline duct there is a distinct shell-gland of rounded shape.

The uterus appears at first as a rounded, thin-walled sac between both groups of the ovary. It then grows very rapidly, sending out oval diverticula laterally, and usually beyond the excretory vessels as well. All of these sacs then flow together to form a larger one, which at this point has already a more distinct cellular wall. It is an interesting feature that the testes and the receptaculum seminis still persist for a rather long time, the uterus having already occupied transversely almost the whole of the proglottis. In the last few segments the wall of the uterus atrophies, and they are entirely occupied by the ova. The ripe ova measure  $64\mu$  by  $54\mu$  in diameter.

The type specimen is in the Parasitological Museum of the Royal Hungarian Veterinary College, Budapest.



*DILEPIS HORVÁTHI*, sp. n.Host: *Megapodius brunneiventris*, Mey.

Locality: Friedrich-Wilhelmshafen.

Among the cestodes collected from this bird I found only a few chains belonging to this new species. With the naked eye it is not easy to distinguish them from *D. leptophallus*. The worms are apparently somewhat shorter than the latter species, the longest specimens measuring 50 mm. The scolex closely resembles in its shape and size that of the former species, being 0.8 mm. in width. The rostellum is still larger, and when retracted it extends with its posterior end to 0.7 mm. behind the posterior border of the suckers. On the anterior knob-like thickening there are fifty-two hooks arranged in a double row; there is but little difference in size between the hooks of the two rows. I found them to be  $99\mu$  in length in the anterior, and  $102\mu$  in the posterior row. The shape, especially that of the anterior hooks, slightly differs from the type shown in the two other species. The suckers are rounded in shape and measure 0.3 mm. in diameter. There is no neck, except in stretched specimens; the segmentation begins a short distance

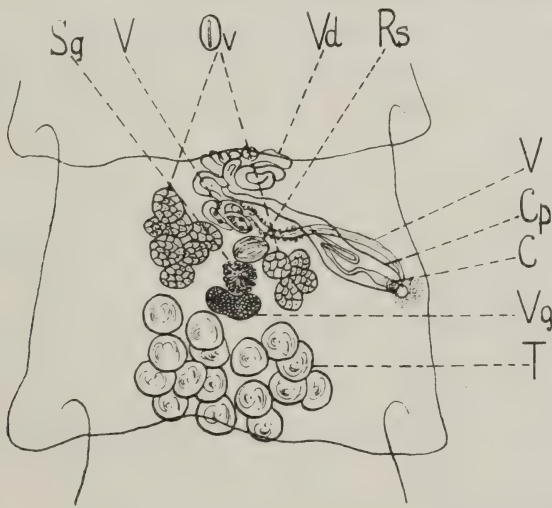


FIG. 7. *D. horvathi*, sp.n. Mature segment. C.—cirrus; Cp.—cirrus pouch; Ov.—ovary; Rs.—receptaculum seminis; Sg.—shell gland; T.—testes; V.—vagina; Vd.—vas deferens; Vg.—vitelline gland.  $\times 80$ .

behind the suckers. The segments in my few chains are usually broader than long, and show otherwise the same features as in *D. leptophallus*. The greatest breadth found in the posterior part of the strobila is 1.5 mm.

Owing to the small number of specimens available belonging to this species, I omitted to sacrifice a chain for the purpose of cutting sections. The following description of the arrangement of the sexual organs is, therefore, based mainly upon worms stained as a whole with boraxcarmin and mounted in balsam.

The genital pores are unilateral, and lie about the middle of the lateral border. It seems that the atrium genitale is of the same extent as in *D. leptophallus*.

The cirrus pouch is a somewhat shorter but wider tube than it is in the former species, measuring about 0.2 mm. in length and 0.04 mm. in breadth; it is usually directed with its long axis obliquely forwards. Within the cirrus pouch is found the rather long cirrus, which at its extremity is distinctly thickened and covered with minute spines. The vas deferens forms many coils, which lie mainly in the middle of the anterior end of the proglottides. The testes lie behind the female organs; it seems that they are less numerous (about fifteen to seventeen) than in the former worm; they measure  $54\mu$  to  $64\mu$ .

The vagina rises anterior to the cirrus pouch; it crosses the posterior end of this organ and then forms apparently as many coils as that of *D. leptophallus*. A rounded receptaculum seminis is similarly present.

The ovary exhibits the same peculiarities as in *D. leptophallus*. If any difference exists in the structure of this organ in both forms, it might perhaps lie in the somewhat fewer number of the ovarian lobes on both the poral and antiporal side.

The vitelline-gland is similar in shape and size to that of the former species.

As gravid segments were not at hand, I am unable to give a suitable description of the uterus and the ripe ova.

The main features which distinguish this species from *D. leptophallus* are:—

1. The shape and size of the rostellar-hooks.
2. The shape and size of the cirrus pouch.

I have named this species in honour of Dr. G. Horváth, Director of the Zoological Department of the Hungarian National Museum in Budapest.

The type specimen is in the Parasitological Museum of the Royal Hungarian Veterinary College, Budapest.

Among the known representatives of the genus *Dilepis*, there is, I believe, none which exhibits a closer resemblance, so far as the above-mentioned peculiarities are concerned. The type of the hooks might in some respects be likened to those of *D. macrocephala*, Fuhrm. (1908), the scolex and rostellum of which are likewise strong.

All the three species described above are closely related to each other. This is proved by the following features:—

1. The structure of the scolex and its integrate parts (especially the rostellum and hooks).
2. The structure of the male organs, viz., the large cirrus pouch, the reduced number of testes.
3. The structure of the female organs in general and mainly of the ovary.

In philogenetic respects it seems doubtless that the three forms, but particularly *D. yorkei*, are very old representatives of the genus *Dilepis*, and might be perhaps interpreted as a distinct group within this genus.

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